

WHAT IS CLAIMED IS:

1. Apparatus for checking the diameter of a cylindrical part, rotating about a geometrical axis, in the course of the machining in a numerical control grinding machine including a grinding-wheel slide, with
  - 5     • a reference device for cooperating with the part to be checked,
  - a measuring device movable with the reference device,
  - a support device for supporting the reference device and the measuring device, the support device having
    - 10       • a support element adapted to be fixed to the grinding-wheel slide,
    - a first coupling element coupled to the support element so as to rotate about a first axis of rotation, and
    - a second coupling element carrying the reference device and coupled to the first coupling element so as to rotate with respect to it about a second axis of rotation parallel to said first axis of rotation,
  - 15     • a control device for controlling automatic displacements of the apparatus from a rest position to a checking condition, in the course of such displacements the reference device performing closing movements with respect to the support element, and
  - 20     • a guiding mechanism associated with the reference device for guiding the arrangement of the latter on the cylindrical part towards the checking condition of the apparatus, the guiding mechanism including a limiting device with at least a pair of abutting surfaces adapted to engage with each other and limit the closing movements of the reference device during said automatic displacements towards the checking condition, and to disengage
  - 25     from each other further to said arrangement of the reference device on the cylindrical part to be checked.

2. Apparatus according to claim 1, wherein said limiting device includes an elongate rigid element that defines at a first end a mechanical abutting surface of said at least a pair, the elongate rigid element being arranged along a direction substantially parallel to said first coupling element and rotatably mounted with respect to the support element.
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3. Apparatus according to claim 2, wherein the limiting device includes bearing and guiding elements coupled to the first coupling element and adapted to bear and guide the elongate rigid element.

- 35     4. Apparatus according to claim 3, wherein the limiting device includes abutment elements, rigidly connected to the support element and to the second coupling element, that define the other abutting surface of said at least a pair,

and an abutting surface of a second pair, the elongate rigid member defining, at its end opposed to the first end, the other abutting surface of said second pair.

5        5. Apparatus according to claim 4, wherein the abutting surfaces of each of said at least a pair and second pair include a substantially planar surface and a convex surface.

10        6. Apparatus according to claim 1 for checking an orbitally rotating crankpin, wherein the reference device is adapted for maintaining contact with the crankpin to be checked substantially owing to the forces of gravity, the apparatus including a counterbalancing spring connected to the support device and adapted to apply to the reference device a thrust opposed to the action of the forces of gravity.

15        7. Apparatus according to claim 6, wherein said spring is arranged between said support element and said first coupling element for applying to the reference device a pulling action that dynamically varies during the displacements of the apparatus.

8. Apparatus according to claim 7, wherein said spring is a torsion spring.

9. Apparatus according to claim 7, wherein said spring is a compression spring.

20        10. Apparatus according to claim 1, wherein the control device is also adapted for controlling automatic displacement of the apparatus from the checking condition to the rest position and includes

- a hooking element connected to the first coupling element, and
- a movable element adapted to cooperate with said hooking element for bringing and keeping the apparatus in the rest position.

25        11. Apparatus according to claim 10, wherein said control device includes a double-acting cylinder.

30        12. Apparatus according to claim 1, wherein the coupling between the second coupling element and the first coupling element includes a device for limiting the rotational displacements of the second coupling element with respect to the first coupling element, and a closing spring.

13. Apparatus according to one of claims 1 to 12, wherein said reference device is substantially of a Vee-shaped type.

35        14. Apparatus according to claim 13, wherein the measuring device includes a feeler adapted to touch the surface of the part to be checked, and a transmission rod carrying the feeler and axially movable substantially along the bisecting line of the Vee-shaped reference device.

15. Apparatus according to claim 14, wherein said measuring device further includes a guide casing fixed to the second coupling element, the transmission rod being axially movable within the guide casing, the feeler being eccentrically fixed to an end of said transmission rod for contacting the part, a  
5 measurement transducer fixed to the guide casing and provided with a movable element cooperating with the other end of the transmission rod, and a device for preventing rotational displacements of the transmission rod with respect to the guide casing.

16. Apparatus according to claim 15, wherein said device for preventing  
10 rotational displacement of the transmission rod with respect to the guide casing comprises a metal bellows having its ends fixed to the transmission rod and to the guide casing, respectively.

17. Apparatus for checking the diameter of a pin, orbitally rotating about a geometrical axis, in the course of the machining in a numerical control  
15 grinding machine including a worktable, defining said geometrical axis, and a grinding-wheel slide carrying a grinding-wheel, with

- a reference device for cooperating with the pin to be checked,
- a measuring device movable with the reference device,
- a support device for supporting the reference device and the measuring  
20 device, the support device having
  - a support element fixed to the grinding-wheel slide,
  - a first coupling element coupled to the support element so as to rotate about an axis of rotation parallel to said geometrical axis,
  - a second coupling element carrying the reference device and coupled  
25 to the first coupling element so as to rotate with respect to it about a second axis of rotation parallel to said geometrical axis,
- a control device for controlling automatic displacements of the apparatus from a rest position to a checking condition, and vice versa, in the course of such displacements the reference device performing closing movements  
30 towards the grinding-wheel and, respectively, movements far from the grinding-wheel, and
- a guiding mechanism, associated with the reference device for guiding the arrangement of the latter on the pin towards said checking condition of the apparatus, and including a limiting device between the grinding-wheel slide and the second coupling element, with at least a pair of mechanical abutting  
35 surfaces adapted to engage with each other and limit the closing movements of the reference device during said automatic displacements towards the

checking condition, and to disengage from each other further to said arrangement of the reference device on the pin to be checked.

18. Apparatus according to claims 17, wherein said reference device is substantially of a Vee-shaped type.

5        19. Apparatus according to claim 18, wherein said limiting device includes abutment elements, rigidly connected to the support element and to the second coupling element, and an elongate rigid element, one of said abutment elements and an end of the elongate rigid element defining said at least a pair of mechanical abutting surfaces, the elongate rigid element being  
10 arranged along a direction substantially parallel to said first coupling element and rotatably mounted with respect to the support element.

20. Apparatus according to one of claims 17 to 19, wherein the reference device is adapted for maintaining contact with the pin to be checked substantially owing to the forces of gravity, the apparatus including a  
15 counterbalancing spring connected to the support device and adapted to apply to the reference device a pulling action, opposed to the action of the forces of gravity, that dynamically varies during the displacements of the apparatus.